



Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854
Attn: Tom Kawa

January 23, 2019

Dear Mr. Kawa,

Enclosed please find the toxicological evaluation and chemical analyses report for the effluent sample received on January 7th, 2019. This is your first quarter 2019 bioassay. Please call me at (401) 353-3420 if you have any questions.

Sincerely,

Michael McCallum
Technical Laboratory Director

NEW ENGLAND TESTING LABORATORY, INC.

59 Green Hill Street, West Warwick, RI 02893

(401) 353-3420

TOXICOLOGICAL EVALUATION
AND CHEMICAL ANALYSES
OF EFFLUENT:
NPDES Permit # MA0100633
First Quarter 2019 Sample
Lowell

Prepared For:
Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854

January 23, 2018

By
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, Rhode Island 02893

NETLAB CASE NUMBER: 9A07016



New England Bioassay

A Division of GZA



NEW ENGLAND BIOASSAY A DIVISION OF GZA CHRONIC AQUATIC TOXICITY TEST REPORT

Permittee: Lowell RWWU NPDES # MA0100633
Report submitted to: New England Testing Laboratories
59 Greenhill Street, West Warwick RI
Sample ID: Effluent
Test Month/Year: January 2019
NEB Proj # 05.0044476.00

Test Type / Method: *Ceriodaphnia dubia* Modified Chronic Static-Renewal Freshwater
Test Method 1002.0; EPA 821-R-02-013

Effluent Sample Dates: #1 1/6-7/19 #2 1/8-9/19 #3 1/10-11/19

Test Start Date: 1/8/19

Results Summary

Your results were as follows:

Passed all permit limits

Acute Test Results

Species	LC50	A-NOEC	Permit Limit	Pass / Fail
<i>Ceriodaphnia dubia</i>	>100%	100%	≥ 100%	Pass

Chronic Test Results

Species	C-NOEC	C-LOEC	IC25	Permit Limit	Pass/Fail
<i>Ceriodaphnia dubia</i>	100%	>100%	>100%	N/A	N/A

Data Qualifiers affecting this test:

This test is considered to be conditionally valid. See "Results Discussion" on *Ceriodaphnia* Test Results page for explanation.

Certifications & Approvals: NH ELAP (2071), NJ DEP (CT405)

This report shall not be reproduced, except in its entirety, without approval of NEB. NEB is the sole authority for authorizing edits or modifications to the data contained in this report. NEB holds no responsibility for results and/or data that are not consistent with the original. Please contact the Lab Manager, Kimberly Wills, at 860-858-3153 or kimberly.wills@gza.com if you have questions concerning these results.

Test Report Certification

Permittee name: Lowell RWWU Permit number: MA0100633
Client sample ID: Effluent Test Start Date: 1/8/19

Whole Effluent Toxicity Test Report Certification (Permittee)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____
(Date)

Authorized Signature

Print or Type Name and Title

Print or Type the Permittee's Name

MA0100633

Print or Type the NPDES Permit Number

Whole Effluent Toxicity Test Report Certification (Bioassay Laboratory)

The results reported relate only to the samples submitted as received

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____

1/23/19
(Date)

Kimberly Wills

Laboratory Manager

New England Bioassay a division of GZA

General Test Conditions

Permittee name Lowell RWWU Permit number: MA0100633
Client sample ID Effluent Test Start Date: 1/8/19

Sample Collection Information

Effluent #1 Dates/Times: 1/6-7/19 @ 0700-0700 Receiving Water #1 Date/Time: 1/7/19 @ 0715

Effluent #2 Dates/Times: 1/8-9/19 @ 0700-0700 Receiving Water #2 Date/Time: 1/9/19 @ 0745

Effluent #3 Dates/Times: 1/10-11/19 @ 0700-0700 Receiving Water #3 Date/Time: 1/11/19 @ 0745

Were a minimum of three samples collected? Yes ☒ No ☐ *(see note below)

Were samples used within the first 36 hours of collection? Yes ☒ No ☐ *(see note below)

* sample collection note:

Test Conditions

Permittee's Receiving Water: Merrimack River

- Dilution water: Laboratory synthetic soft water (hardness 45 - 55 mg/L CaCO₃)
- Control water: Receiving water collected at a point immediately upstream of or away from the discharge

Effluent concentrations tested: 0%, 6.25%, 12.5%, 25%, 50%, 100%

Was effluent salinity adjusted? No ☒ Yes ☐ with Instant Ocean sea salts to _____ ppt

Dechlorination procedures: Chlorine is measured using 4500 CL-G DPD Colorimetric Method

- Dechlorination was not required

TRC results and further information about aeration of samples can be found attached in "sample receipt chemistry"

Reference Toxicant Data

Ceriodaphnia dubia

Date: 1/2/19
Toxicant: Sodium chloride
Dilution Water: NEB CTRMH
Organism Source: NEB
Reproduction IC25: 1.19 g/L
Results within range Yes ☒ No ☐

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633
 Client sample ID: Effluent Test Dates: 1/8/19 - 1/16/19

Test Acceptability Criteria

Lab Diluent Survival: 90 % Mean Lab Diluent Reproduction: 5.8* young per female
 River Control Survival: 90 % Mean River Control Reproduction: 26 young per female
 Thiosulfate Control Survival: NA % Mean Thiosulfate Control Reproduction: NA young per female
 Presence of an asterisk (*) indicates EPA criteria was not met, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Results

		Permit Limit	Test Result	Pass/Fail Status
Acute Data	48 hr LC50	≥ 100%	>100%	Pass
	48 hr NOEC		100%	
	TUa			
Chronic Data	Chronic LC50		>100%	
	Survival C-NOEC		100%	
	Survival C-LOEC		>100%	
	Reproduction C-NOEC		100%	
	Reproduction C-LOEC		>100%	
	Reproduction IC25		>100%	
	Reproduction IC50		>100%	
	Reportable C-NOEC		100%	*
	Reportable C-LOEC		>100%	*
	MATC		>100%	
	TUc			

Presence of an asterisk (*) indicates qualified data, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Variability

- Reproduction PMSD: 19.9% Upper & Lower EPA bounds: 13 - 47% ☐ Low ☒ Within bounds ☐ High
☐ PMSD exceeds upper bounds. Test results are highly variable and may not be sensitive enough to determine the presence of toxicity at the permit limit concentration (PLC)
☒ The PMSD falls within the upper (47%) and lower (13%) bounds. Results are reportable.
☐ PMSD falls below the lower bound test variability criterion. The test is very sensitive. The relative percent difference (RPD) between the control and each treatment was calculated and compared to the lower bound.
☐ The RPD values for all concentrations fall below the lower bound. Any differences observed in this test are considered statistically insignificant.
☐ Some of the concentrations that were flagged as statistically significant have RPD values that fall below the lower bound. Any differences observed in these concentrations will not be considered statistically significantly decreased from the control.
☐ No statistically significant reductions were observed in this test.

***Ceriodaphnia dubia* Test Results**

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 1/8/19 - 1/16/19

Concentration - Response Evaluation

Survival: #12 No significant effects at any test concentration with a flat concentration-response curve. Test concentrations performed very similarly to dilution control.

Reproduction: #12 No significant effects at any test concentration with a relatively flat concentration-response curve. Test concentrations performed both above and below (but similarly to) the dilution control.

The concentration - response relationship was reviewed and the following determination was made:

Survival	Reproduction	
<u>X</u>	<u> </u>	Results are reliable and reportable
<u> </u>	<u>X</u>	Results are anomalous (see explanation below)
<u> </u>	<u> </u>	Results are inconclusive - retest (see explanation below)

Results Discussion (if applicable):

*Please note that reproduction in the laboratory dilution water was only 5.8 young per female at test completion which failed to meet the EPA acceptability criteria of an average of 15 young per female with 60% of females producing three broods of young during the test period. Survival statistics were run against the laboratory water which met the EPA acceptability criterion for survival in a chronic test. Because reproduction in the effluent test concentrations showed reproductive values ranging from 21.5 to 33.9 young per female, NEB ran a statistical comparison of reproduction against the receiving water (Merrimack River) control which met all EPA validity criteria. The results of the statistical analysis showed no reduction in reproduction in any of the test concentrations when compared with the Merrimack River control (26.0 young per female). The test concentrations also showed increasing reproduction with increasing effluent concentration. The 100% effluent produced an average of 33.9 young per female indicating that the pure effluent did not exert an adverse effect on the test organisms. We are considering this test to be conditionally valid and are reporting the NOEC as 100% effluent for the *Ceriodaphnia* test.

TEST METHODS

Ceriodaphnia dubia

Test type:	Modified Chronic Static Renewal Freshwater Test
Test Reference Manual:	EPA-821-R-02-013 "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms"
Test Method:	<i>Ceriodaphnia dubia</i> Survival and Reproduction Test - EPA 1002.0
Temperature:	25 °C ± 1°C (Temperatures should not deviate by more than 3°C during the test) (required)
Light Quality:	Ambient Laboratory Illumination (recommended)
Light Intensity:	10-20 µE/m ² /s, or 50-100 ft-c (recommended)
Photoperiod:	16 hours light, 8 hours dark (recommended)
Test chamber size:	30 mL (recommended minimum)
Test solution volume:	15 mL (recommended minimum)
Renewal of Test Solutions:	Daily (required)
Age of Test Organisms:	Less than 24 hours; and all released within a 8-h period (required)
Number of Neonates Per Test Chamber:	1 Assigned using blocking by known parentage (required)
Number of Replicate Test Chambers Per Treatment:	10 (required minimum)
Number of Neonates Per Test Concentration:	10 (required minimum)
Feeding Regime:	Fed 0.1 mL each of YCT and algal suspension per exposure chamber daily. (recommended)
Cleaning:	Use new plastic cups daily (recommended)
Aeration:	None (recommended)
Test Duration:	Until 60% or more of control females have three broods (maximum test duration 8 days) (required)
Endpoints:	Survival and reproduction (required)
Test Acceptability:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods. (required)
Sampling Requirements:	Minimum of three samples with a maximum holding time of 36 hours before first use. (required)
Sample volume required:	1 L/Day (recommended)

CERIODAPHNIA DUBIA DATASHEETS & STATISTICAL ANALYSIS

NEW ENGLAND BIOASSAY TOXICITY DATA FORM

CHRONIC COVER SHEET

CLIENT: New England Testing Laboratories
 ADDRESS: 59 Greenhill Street
West Warwick, RI 02893
 PERMITTEE: Lowell RWWU
 PERMIT NUMBER: MA0100633
 DILUTION WATER: Laboratory Soft Water

C.dubia TEST ID # 19-30
 CHAIN OF CUSTODY # C39-1029/30
 NEB PROJECT # 05.0044476.00
 SAMPLE ID: Effluent

INVERTEBRATES

TEST SET-UP TECHNICIAN: TBP
 TEST SPECIES: *Ceriodaphnia dubia*
 NEB LOT # Cd18(RMH 300)
 AGE: < 24 hours
 TEST SOLUTION VOLUME (mls): 15
 ORGANISMS PER TEST CHAMBER: 1
 ORGANISMS PER CONCENTRATION: 10

LABORATORY CONTROL WATER (SRCF)

Lot Number	Hardness mg/L CaCO ₃	Alkalinity mg/L CaCO ₃
C38-S029	50	35

	DATE	TIME
TEST START:	1/8/19	0947
TEST END:	1/16/19	1112

COMMENTS: _____

REVIEWED BY:  DATE: 1/23/19

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS: Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850			
NEB PROJECT NUMBER: 05.0044476.00		NEB TEST NUMBER: 19-30	COC # C39-1029/30
TEST ORGANISM: <i>Ceriodaphnia dubia</i>		AGE: <24 hours	Lot # Cd18(RMH 300)
START DATE: 1/8/19	TIME: 0947	END DATE: 1/16/19	TIME: 1112

Effluent Concentration	Culture Lot# Cd18(RMH 300)											Total Live Young	# Live Adults	Analyst- Transfer	Analyst- Counts
	Cup #	A2	A5	A12	A13	B3	B4	B5	B6	B11	B12				
	Day Number	Replicate													
		A	B	C	D	E	F	G	H	I	J				
NEB Lab Synthetic Diluent	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	TBP	
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CH	
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CW	
	3	4	✓	4	2	4	✓	3	4	4	2	27	10	CH	CH
	4	1	✓	5	✓	✓	✓	✓	✓	1	✓	7	10	PD	PD
	5	✓	✓	✓	5	✓	✓	✓	✓	✓	5	10	10	PD	PD
	6	✓	✓	✓	6	✓	✓	✓	✓	✓	✓	6	10	TBP	TBP
	7	✓	✓	✓	8	✓	✓/x	✓	✓	✓	✓	8	9	KO	KO
	totals	5	0	9	21	4	0	3	4	5	7	58	9		MC
Merrimack River Control		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	5	5	6	6	2	6	6	7/x	6	6	55	9		
	4	12	13	11	11	4	9	8	X	12	10	90	9		
	5	16	✓	✓	✓	✓	✓	✓	X	✓	✓	16	9		
	6	✓	9	10	9	11	11	13	X	2	12	77	9		
	7	14	✓	8	3	3	✓	6	X	✓	2	22	9		
totals	33	27	35	29	20	26	33	7	20	30	260	9			
6.25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	1	✓	✓	2	4	✓	✓	✓	✓	2	9	10		
	4	6	✓	6	✓	7	✓	3	✓	6	4	32	10		
	5	✓	✓	✓	5	✓	✓	✓	✓	✓	✓	5	10		
	6	9	11	7	7	8	12	9	10	9	8	90	10		
	7	7	4	6	8	11	10	9	7	7	10	79	10		
totals	23	15	19	22	30	22	21	17	22	24	215	10			

Notes: Replicates in which the neonates are marked with a strike are judged to contain 4th broods (rather than split-broods), and the 4th brood is not included in the reproduction totals per EPA-821-R-02-013.

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850												
NEB PROJECT NUMBER:	05.0044476.00	ORGANISM: <i>Ceriodaphnia dubia</i>										START DATE:	1/8/19

Effluent Concentration	Day Number	Replicate										Total Live Young	# Live Adults		
		A	B	C	D	E	F	G	H	I	J				
12.5%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	3	✓	3	4	✓	3	13	10		
	4	6	7	5	4	3	6	6	7	6	✓	50	10		
	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	1	1	10		
	6	11	11	11	11	13	9	10	10	11	10	107	10		
	7	9	7	8	10	4	12	8	9	10	10	87	10		
	totals	26	25	24	25	23	27	27	30	27	24	258	10		
25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	2	✓	✓	✓	1	4	✓	✓	4	11	10		
	4	4	8	4	✓	7	7	5	6	4	4	49	10		
	5	✓	✓	✓	6	✓	✓	✓	✓	✓	✓	6	10		
	6	10	12	11	12	11	12	9	11	8	10	106	10		
	7	13	13	13	14	3	5	13	12	11	11	108	10		
	totals	27	35	28	32	21	25	31	29	23	29	280	10		
50%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	6	6	6	5	5	6	3	✓	3	4	44	10		
	4	8	10	10	10	8	8	8	8	7	6	83	10		
	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	6	16	17	18	18	15	17	15	13	13	18	160	10		
	7	9	16	19	14	17	17	14	17	12	15	0	10		
	totals	30	33	34	33	28	31	26	21	23	28	287	10		
100%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	5	2	6	4	5	6	5	6	6	4	49	10		
	4	8	14	11	14	12	7	13	15	8	12	114	10		
	5	✓	✓	12	✓	✓	✓	✓	✓	✓	✓	12	10		
	6	10	20	✓	13	18	23	18	20	21	21	164	10		
	7	17	15	15	11	16	17	15	20	18	21	0	10		
	totals	23	36	29	31	35	36	36	41	35	37	339	10		

CETIS Analytical Report

Report Date: 17 Jan-19 08:51 (p 1 of 6)
 Test Code/ID: 19-30 / 00-5683-7600

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 10-6922-8825	Endpoint: 2d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 00-3586-0677	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 08 Jan-19 09:47	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 16 Jan-19 11:12	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 8d 1h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 20-7067-7991	Code: 7B6C09E7	Project:
Sample Date: 09 Jan-19 07:00	Material: Not Applicable	Source: Lowell RWWU (MA0100633)
Receipt Date: 09 Jan-19 15:13	CAS (PC):	Station:
Sample Age: n/a	Client: New England Testing Labs	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	435530	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

2d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

2d Survival Rate Detail

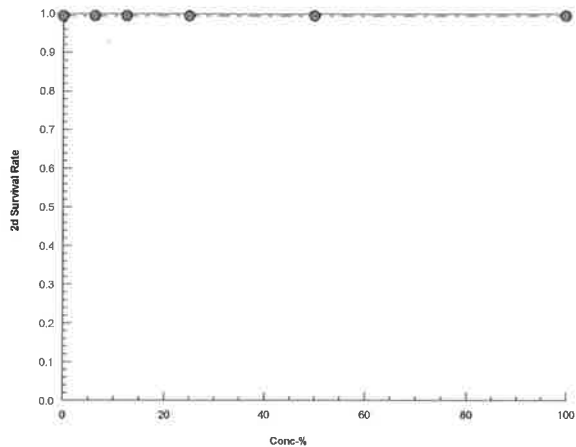
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

2d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test		New England Bioassay	
Analysis ID:	10-6922-8825	Endpoint:	2d Survival Rate
Analyzed:	17 Jan-19 8:50	Analysis:	Linear Interpolation (ICPIN)
		CETIS Version:	CETISv1.9.4
		Status Level:	1

Graphics



CETIS Analytical Report

Report Date: 17 Jan-19 08:51 (p 3 of 6)
 Test Code/ID: 19-30 / 00-5683-7600

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 06-7677-8478	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 00-3586-0677	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 08 Jan-19 09:47	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 16 Jan-19 11:12	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 8d 1h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 20-7067-7991	Code: 7B6C09E7	Project:
Sample Date: 09 Jan-19 07:00	Material: Not Applicable	Source: Lowell RWWU (MA0100633)
Receipt Date: 09 Jan-19 15:13	CAS (PC):	Station:
Sample Age: n/a	Client: New England Testing Labs	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1683232	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits		Overlap	Decision
Attribute	Test Stat	Lower	Upper		
Control Resp	0.9	0.8	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

7d Survival Rate Summary

		Calculated Variate(A/B)								Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.9833	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

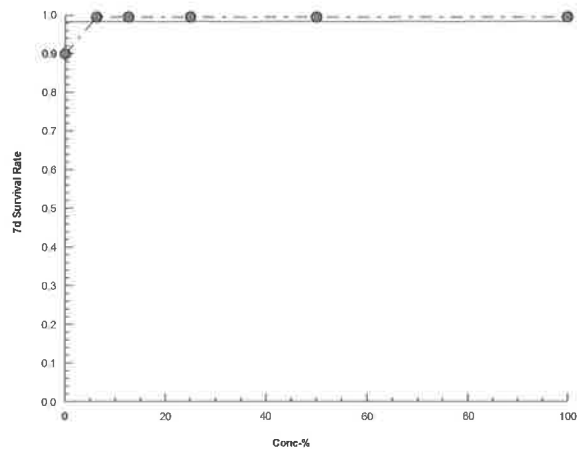
7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID: 06-7677-8478	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

Graphics



CETIS Analytical Report

Report Date: 17 Jan-19 08:51 (p 5 of 6)
Test Code/ID: 19-30 / 00-5683-7600

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 13-7398-4311	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 00-3586-0677	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 08 Jan-19 09:47	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 16 Jan-19 11:12	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 8d 1h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 20-7067-7991	Code: 7B6C09E7	Project:
Sample Date: 09 Jan-19 07:00	Material: Not Applicable	Source: Lowell RWWU (MA0100633)
Receipt Date: 09 Jan-19 15:13	CAS (PC):	Station:
Sample Age: n/a	Client: New England Testing Labs	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	348600	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits		Overlap	Decision
Attribute	Test Stat	Lower	Upper		
Control Resp	26	15	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

Reproduction Summary

		Calculated Variate							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	D	10	26	7	35	8.42	32.38%	0.0%	27.32	0.0%
6.25		10	21.5	15	30	4.089	19.02%	17.31%	27.32	0.0%
12.5		10	25.8	23	30	2.044	7.92%	0.77%	27.32	0.0%
25		10	28	21	35	4.216	15.06%	-7.69%	27.32	0.0%
50		10	28.7	21	34	4.373	15.24%	-10.38%	27.32	0.0%
100		10	33.9	23	41	5.021	14.81%	-30.38%	27.32	0.0%

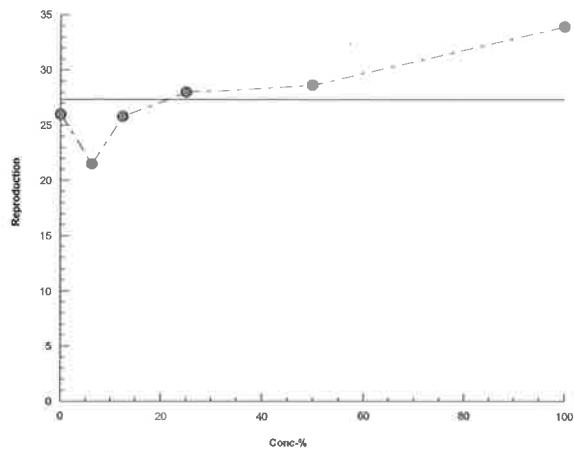
Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	33	27	35	29	20	26	33	7	20	30
6.25		23	15	19	22	30	22	21	17	22	24
12.5		26	25	24	25	23	27	27	30	27	24
25		27	35	28	32	21	25	31	29	23	29
50		30	33	34	33	28	31	26	21	23	28
100		23	36	29	31	35	36	36	41	35	37

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID: 13-7398-4311	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

Graphics



CETIS Analytical Report

Report Date: 17 Jan-19 08:51 (p 1 of 2)

Test Code/ID: 19-30 / 00-5683-7600

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 18-6740-5390	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: STP 2xK Contingency Tables	Status Level: 1
Batch ID: 00-3586-0677	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 08 Jan-19 09:47	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 16 Jan-19 11:12	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 8d 1h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 20-7067-7991	Code: 7B6C09E7	Project:
Sample Date: 09 Jan-19 07:00	Material: Not Applicable	Source: Lowell RWWU (MA0100633)
Receipt Date: 09 Jan-19 15:13	CAS (PC):	Station:
Sample Age: n/a	Client: New England Testing Labs	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	>100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.0000	Exact	1.0000	Non-Significant Effect
		12.5	1.0000	Exact	1.0000	Non-Significant Effect
		25	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

Test Acceptability Criteria

TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.9	0.8	>>	Yes	Passes Criteria

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	9	1	10	0.9	0.1	0.0%
6.25		10	0	10	1	0	-11.11%
12.5		10	0	10	1	0	-11.11%
25		10	0	10	1	0	-11.11%
50		10	0	10	1	0	-11.11%
100		10	0	10	1	0	-11.11%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

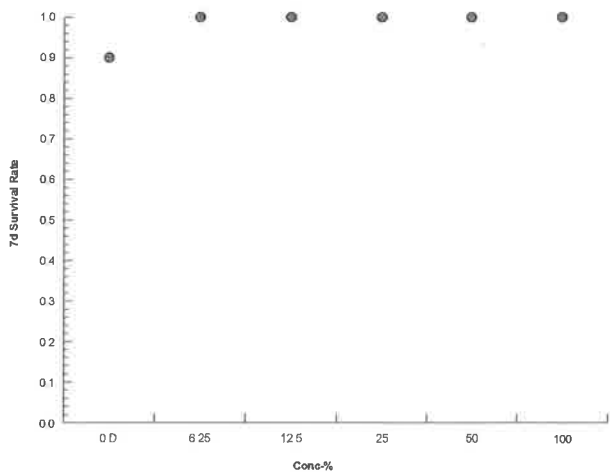
7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID:	18-6740-5390	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	17 Jan-19 8:50	Analysis:	STP 2xK Contingency Tables	Status Level:	1

Graphics



CETIS Analytical Report

Report Date: 17 Jan-19 08:51 (p 1 of 2)
Test Code/ID: 19-30 / 00-5683-7600

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 15-9250-0164	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: Nonparametric-Control vs Treatments	Status Level: 1
Batch ID: 00-3586-0677	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 08 Jan-19 09:47	Protocol: EPA/821/R-02-013 (2002)	Diluent: Laboratory Water
Ending Date: 16 Jan-19 11:12	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 8d 1h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 20-7067-7991	Code: 7B6C09E7	Project:
Sample Date: 09 Jan-19 07:00	Material: Not Applicable	Source: Lowell RWWU (MA0100633)
Receipt Date: 09 Jan-19 15:13	CAS (PC):	Station:
Sample Age: n/a	Client: New England Testing Labs	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	>100	n/a	1	19.94%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	82.5	75	1	18	Asymp	0.1507	Non-Significant Effect
		12.5	93.5	75	3	18	Asymp	0.4745	Non-Significant Effect
		25	108	75	3	18	Asymp	0.8923	Non-Significant Effect
		50	113	75	3	18	Asymp	0.9548	Non-Significant Effect
		100	139.5	75	2	18	Asymp	1.0000	Non-Significant Effect

Test Acceptability Criteria

TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	26	15	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	835.883	167.177	5	6.518	8.3E-05	Significant Effect
Error	1385.1	25.65	54			
Total	2220.98		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	16.42	15.09	0.0057	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9373	0.9459	0.0041	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	10	26	19.98	32.02	28	7	35	2.662	32.38%	0.00%
6.25		10	21.5	18.57	24.43	22	15	30	1.293	19.02%	17.31%
12.5		10	25.8	24.34	27.26	25.5	23	30	0.6464	7.92%	0.77%
25		10	28	24.98	31.02	28.5	21	35	1.333	15.06%	-7.69%
50		10	28.7	25.57	31.83	29	21	34	1.383	15.24%	-10.38%
100		10	33.9	30.31	37.49	35.5	23	41	1.588	14.81%	-30.38%

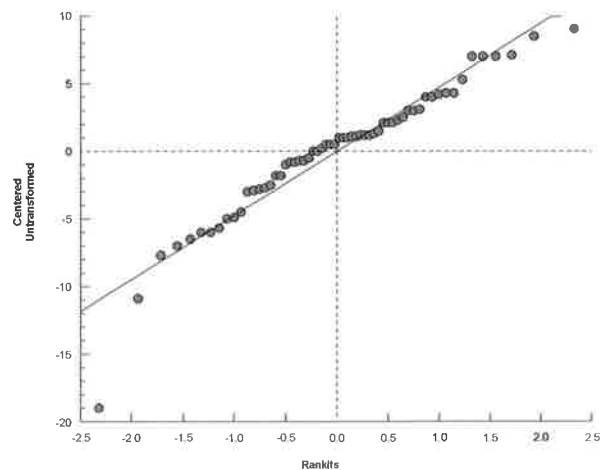
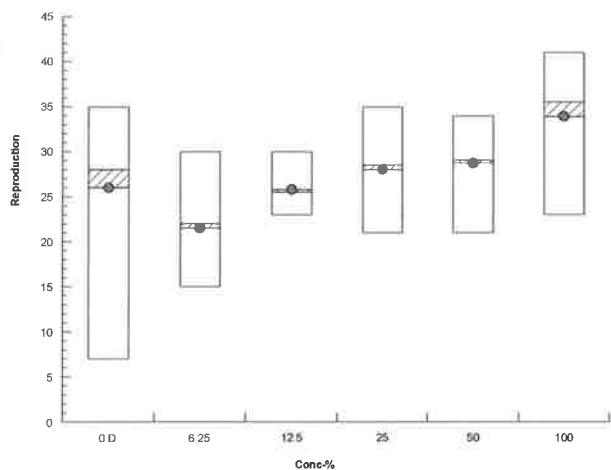
Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	33	27	35	29	20	26	33	7	20	30
6.25		23	15	19	22	30	22	21	17	22	24
12.5		26	25	24	25	23	27	27	30	27	24
25		27	35	28	32	21	25	31	29	23	29
50		30	33	34	33	28	31	26	21	23	28
100		23	36	29	31	35	36	36	41	35	37

Ceriodaphnia 7-d Survival and Reproduction Test New England Bioassay

Analysis ID: 15-9250-0164	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 17 Jan-19 8:50	Analysis: Nonparametric-Control vs Treatments	Status Level: 1

Graphics



NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:		Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850						
NEB PROJECT NUMBER:		05.0044476.00			TEST ORGANISM		Ceriodaphnia dubia	
DILUTION WATER SOURCE:		Laboratory Soft Water			START DATE:		1/8/19	TIME: 0947
ANALYST	TBP	MM	CW	MM	PD	PD	MM	CH
NEB Lab Diluent	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.3	25.4	25.2	25.2	24.0	25.0	24.1	24.0
D.O. mg/L Initial	8.2	8.1	8.0	8.2	8.5	8.4	8.4	8.9
pH s.u. Initial	7.4	7.4	7.6	7.6	7.6	7.3	7.7	7.8
Conductivity µS Initial	185	184	184	183	185	184	186	182
Temp °C Final	24.6	24.0	24.7	24.0	24.0	24.0	24.1	24.0
D.O. mg/L Final	8.3	8.3	8.3	8.6	8.6	8.3	8.2	8.2
pH s.u. Final	7.7	7.9	7.6	8.0	8.0	7.4	7.9	7.6
Conductivity µS Final	200	198	197	203	201	201	197	195
Merrimack River Control	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.1	25.4	25.2	25.3	24.0	25.0	25.4	24.5
D.O. mg/L Initial	10.3	9.0	9.5	9.2	9.4	9.0	8.6	9.1
pH s.u. Initial	7.2	7.3	7.5	7.5	7.5	7.3	7.7	7.8
Conductivity µS Initial	153	153	164	164	205	203	206	203
Temp °C Final	24.9	24.0	24.7	24.0	24.0	24.0	24.2	24.1
D.O. mg/L Final	8.2	8.2	8.3	8.6	8.5	8.3	8.1	8.1
pH s.u. Final	7.6	7.7	7.5	7.9	7.9	7.5	7.8	7.6
Conductivity µS Final	162	166	173	179	220	215	217	216
6.25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.6	25.3	25.0	25.6	24.0	25.4	25.0	24.0
D.O. mg/L Initial	8.2	8.1	9.0	8.2	8.5	8.7	8.5	8.9
pH s.u. Initial	7.5	7.4	7.5	7.4	7.7	7.3	7.6	7.6
Conductivity µS Initial	236	238	266	249	258	265	260	261
Temp °C Final	25.2	24.0	24.7	24.0	24.0	24.0	24.2	24.1
D.O. mg/L Final	8.0	8.2	8.3	8.5	8.5	8.4	8.0	8.1
pH s.u. Final	7.6	7.7	7.4	7.8	7.8	7.4	7.7	7.6
Conductivity µS Final	245	249	274	263	270	277	270	273
12.5%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.5	25.4	25.2	25.5	24.0	25.1	24.6	24.0
D.O. mg/L Initial	8.2	8.0	8.2	8.2	8.5	8.4	8.3	8.8
pH s.u. Initial	7.5	7.4	7.5	7.5	7.7	7.3	7.6	7.6
Conductivity µS Initial	288	289	339	339	343	334	334	329
Temp °C Final	25.3	24.0	24.8	24.0	24.0	24.0	24.1	24.1
D.O. mg/L Final	8.1	8.3	8.3	8.5	8.5	8.4	8.2	8.1
pH s.u. Final	7.6	7.7	7.5	7.8	7.8	7.4	7.7	7.6
Conductivity µS Final	300	304	351	360	358	348	345	340

NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

[illegible]

Table of Random Permutations of 16

C.dubia Test ID#

19-30

7	12	15	15	1	2	7	16	10	2	14	15	7	13	13	10	6	1	8	10
13	3	8	16	7	10	11	10	13	5	11	7	13	16	7	7	5	13	2	14
3	1	4	5	14	13	3	14	9	13	13	2	9	15	6	2	8	4	5	8
11	8	16	14	15	6	2	6	2	16	8	5	12	3	9	13	4	3	10	4
14	9	1	6	3	9	14	13	8	6	5	8	14	7	3	15	13	11	4	7
2	16	10	13	5	5	13	2	11	7	3	12	5	14	12	16	2	2	9	15
4	6	13	7	2	15	1	9	1	4	7	10	6	9	11	9	7	6	16	11
6	14	6	10	4	14	4	15	3	3	4	16	2	6	5	1	12	10	6	9
10	15	2	1	13	12	16	3	4	8	10	1	15	5	14	12	14	12	3	2
12	10	7	12	9	11	9	8	12	14	15	4	11	8	16	8	9	14	14	1
15	7	5	2	10	7	8	12	6	15	6	13	16	12	15	4	11	8	12	6
16	2	11	8	8	8	15	5	16	1	1	9	8	1	8	14	16	5	13	5
9	13	14	3	6	4	10	11	5	12	9	3	10	4	4	3	10	9	1	3
8	11	9	4	11	3	12	7	7	10	12	14	3	10	1	6	15	16	15	12
1	5	12	11	16	16	5	4	14	9	16	11	1	2	10	5	1	15	7	13
5	4	3	9	12	1	6	1	15	11	2	6	4	11	2	11	3	7	11	16
conc																			
11	8	16	5	5	13	1	13	2	16	14	12	9	8	7	5	13	3	13	3
2	2	8	8	14	16	4	3	8	11	10	14	15	1	2	11	4	5	15	9
6	13	2	13	6	5	9	15	11	10	12	6	16	15	16	9	10	12	16	15
14	12	4	16	16	11	14	10	5	12	3	3	12	14	15	13	6	4	1	16
8	6	3	9	4	10	6	4	16	2	2	9	8	16	4	6	5	15	7	8
9	15	12	10	3	2	12	6	1	15	4	13	7	7	9	12	14	8	8	11
3	10	11	12	13	12	5	11	7	8	9	5	14	11	10	1	3	13	3	5
16	1	13	14	8	14	15	5	3	7	11	15	6	12	5	7	11	1	14	4
1	14	14	2	9	15	16	14	6	14	7	8	3	13	11	8	7	7	12	7
4	4	6	4	12	3	11	8	15	9	8	1	13	6	3	3	15	9	9	12
15	5	1	11	10	6	3	7	10	5	5	11	10	10	12	15	16	14	5	2
5	3	5	6	7	7	13	2	14	3	16	4	5	5	13	4	9	16	2	6
12	7	15	15	15	9	8	12	12	13	15	10	1	4	6	16	2	6	11	1
10	11	10	3	2	4	2	1	4	6	6	7	11	9	14	10	8	11	4	13
7	9	7	7	11	1	7	16	13	1	13	2	4	2	1	2	12	2	10	14
13	16	9	1	1	8	10	9	9	4	1	16	2	3	8	14	1	10	6	10
reps																			
1	6	7	4	8	6	5	2	8	15	4	6	6	1	4	5	7	13	2	10
9	15	11	3	11	15	9	10	1	3	8	2	15	7	9	8	16	1	14	3
10	16	4	5	12	9	16	11	7	1	7	16	11	8	3	3	12	2	3	4
4	14	1	9	5	5	4	13	6	8	15	5	12	5	7	16	5	11	8	1
7	3	13	14	15	2	1	14	16	5	14	9	2	16	1	12	6	14	4	13
16	11	2	1	14	16	6	9	3	4	16	14	3	15	11	11	3	9	12	5
3	10	16	16	13	7	13	1	11	14	9	10	16	2	10	2	10	7	10	16
11	13	9	13	4	13	8	3	5	13	10	12	5	12	5	14	13	16	5	6
15	2	3	12	9	12	2	4	13	10	3	13	14	4	2	1	14	8	6	12
14	1	14	6	10	1	3	12	4	2	2	4	13	3	16	9	9	3	7	14
13	12	5	11	3	11	15	8	2	7	11	7	8	14	6	4	4	4	15	11
12	5	10	7	2	14	7	15	14	16	13	1	9	10	12	10	11	10	9	8
8	9	8	10	6	4	11	7	10	11	6	8	4	9	8	15	8	6	11	9
2	7	6	2	1	8	10	6	15	12	1	11	7	11	13	6	1	15	13	15
6	4	15	8	16	10	14	16	9	6	12	3	10	6	14	7	2	12	16	7
5	8	12	15	7	3	12	5	12	9	5	15	1	13	15	13	15	5	1	2
13	4	10	4	16	13	16	13	5	3	6	14	1	16	8	7	2	3	3	12
5	14	4	6	8	2	15	1	13	14	16	4	15	4	3	12	12	1	4	7
2	2	2	15	14	16	9	12	16	6	10	15	14	9	10	1	14	8	8	16
7	12	15	8	12	3	5	14	7	12	5	13	16	1	7	5	11	2	9	3
6	9	7	14	9	14	10	11	15	11	12	1	12	12	14	16	3	11	11	8
14	5	16	7	10	8	11	8	14	13	7	11	6	3	11	4	4	6	6	9
15	11	8	9	7	12	8	7	1	15	9	3	3	7	13	11	10	4	5	1
11	6	6	1	4	1	3	16	12	5	4	9	13	13	6	8	15	9	1	14
4	10	3	16	2	11	7	9	6	9	1	8	4	11	5	2	16	10	12	4
1	8	1	13	1	15	4	4	11	4	2	16	5	8	1	9	5	12	16	6
9	7	14	2	6	4	14	10	9	8	15	10	7	10	9	10	6	14	10	11
12	1	9	10	15	5	2	15	10	2	14	2	8	2	4	13	8	5	15	5
3	3	12	11	5	9	6	6	3	10	13	12	9	6	2	15	7	15	7	13
10	15	11	5	13	7	12	5	2	7	11	5	10	15	12	3	1	13	13	10
8	13	13	3	3	10	13	2	4	1	8	6	11	14	15	6	9	16	2	2
16	16	5	12	11	6	1	3	8	16	3	7	2	5	16	14	13	7	14	15

Brood mother source: 296 A8 Source's brood size: 19 (Qty.)Lowell 1-8-19

Tech	MC	MC	SP	AT	SP	AT	AT	AT			KE	AT	AT			
Date	12-28	12-28	12-30	12-31	1-1	1-2	1-3	1-4			1-6	1-7	1-8			
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup #																
1	N	N	N	N	4	9	4	N	1		Y	Y	N			
2	N	N	N	N	4	8	4	N	2		Y	Y	N			
3	N	N	N	N	3	9	4	N	3		Y	N	(T1) T1 Y ₂₃			
4	N	N	N	N	5	9	4	N	4		Y	Y	(A) (T2) Y ₂₁			
5	N	N	N	N	4	8	4	N	5		Y	N	(T2) T2 Y ₂₁			
6	N	N	N	N	3	7	4	N	6		Y	Y	N			
7	N	N	N	N	3	7	4	N	7		Y	Y	N			
8	N	N	N	N	4	7	4	N	8		Y	Y	N			
9	N	N	N	N	4	8	4	N	9		Y	Y	N			
10	N	N	N	N	3	7	4	N	10		Y	Y	N			
11	N	N	N	N	4	9	4	N	11		Y	Y	N			
12	N	N	N	N	4	8	4	N	12		Y	N	(T3) T3 Y ₂₁			
13	N	N	N	N	4	8	4	N	13		Y	N	(T4) T4 Y ₁₉			

Y = neonates present, and criterion has been met: ≥ 20 neonates produced in total by 3rd brood.

N = no neonates

2B = two broods present. 2Y = two broods and criterion met: ≥ 20 neos. by 3rd brood.

X = brood mother dead ae = aborted eggs

✓ or P = neonates present after renewal on previous day (see time in log).

A → = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted).

acc. = if acclimated, H₂O type used w/ renewal this day.

Test organism collection:

Tray diagram
used?

Project #	Symbols (✓ / P)	(Y/N)	Time period, neonates released	Collection date / time
0561656	T	Y	1-7-19/0958 → 1-7-19/1440	1-8-19/0900
0044476	(T)	Y	1-7-19/0958 → 1-7-19/1440	1-8-19/0900
	T			
	T			
	T			
	T			

Brood mother source: 2910 B3 Source's brood size: 28 (Qty.)

Lowell 1-8-19

Tech	MC		SJP	At	SJP	At	At	At			KE	At	At				
Date	12-28		12-30	12-31	1-1	1-2	1-3	1-4			1-6	1-7	1-8				
Day acc.	0	1	2	3	4	5	6	7			8	9	10	11	12	13	14
Cup #																	
1	N	N	N	N	4	7	Y	N	1		Y	Y	N				
2	N	N	N	N	4	8	Y	N	2		Y	Y	N				
3	N	N	N	N	3	7	Y	N	3		Y	N	(TS) TS Y20				
4	N	N	N	N	3	7	Y	N	4		Y	N	(TS) TS Y19				
5	N	N	N	N	2	8	Y	N	5		Y	N	(TS) TS Y20				
6	N	N	N	N	4	7	Y	N	6		Y	N	(TS) TS Y23				
7	N	N	N	N	3	6	Y	N	7		Y	Y	N				
8	N	N	N	N	4	7	Y	N	8		Y	Y	N				
9	N	N	N	N	4	8	Y	N	9		Y	Y	N				
10	N	N	N	N	3	7	Y	N	10		Y	Y	N				
11	N	N	N	N	3	7	Y	N	11		Y	N	(TS) TS Y23				
12	N	N	N	N	4	6	Y	N	12		Y	N	(TS) TS Y22				
13	N	N	N	N	3	7	Y	N	13		Y	N	Y				

Y = neonates present, and criterion has been met: ≥ 20 neonates produced in total by 3rd brood.

N = no neonates

2B = two broods present. 2Y = two broods and criterion met: ≥ 20 neos. by 3rd brood.

X = brood mother dead ae = aborted eggs

✓ or P = neonates present after renewal on previous day (see time in log).

A → = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted).

acc. = if acclimated, H₂O type used w/ renewal this day.

Test organism collection:

Tray diagram
used?

Project #	Symbols (✓ / P)	(Y/N)	Time period, neonates released	Collection date / time
0561656	T	Y	1-7-19/0950 → 1-7-19/1440	1-8-19/0900
0044476	(T)	Y	1-7-19/0950 → 1-7-19/1440	1-8-19/0900
	T			
	T			
	T			
	T			

SAMPLE RECEIPT CHEMISTRY & CHAIN OF CUSTODY DOCUMENTS

NEW ENGLAND BIOASSAY - INITIAL CHEMISTRY DATA

PERMITTEE: Lowell RWWU
NEB JOB # 05.0044476.00

DATE RECEIVED	1/7/19		1/9/19		1/11/19	
SAMPLE TYPE:	EFF #1	RIVER #1	EFF #2	RIVER #2	EFF #3	RIVER #3
COC #	C39-1029	C39-1030	C39-1079	C39-1080	C39-1115	C39-1116
pH (SU)	6.8	7.0	6.8	7.0	7.1	7.8
Temperature (°C)	3.2	4.0	1.5	1.3	7.0	5.4
Dissolved Oxygen (mg/L)	10.8	12.5	10.2	11.5	11.4	12.5
Conductivity (µmhos)	1,038	151	1,449	166	1,447	205
Salinity (ppt)	<1	<1	<1	<1	<1	<1
TRC - DPD (mg/L)	0.011	0.002	0.012	0.006	0.016	0.3002
TRC - Amperometric (mg/L)	NA	NA	NA	NA	NA	NA
Hardness (mg/L as CaCO ₃)	86	20	124	20	126	22
Alkalinity (mg/l as CaCO ₃)	45	10	60	10	55	15
Tech Initials	CH	CH	MM	MM	PD	PD

NOTE: NA = NOT APPLICABLE

Data Reviewed By:



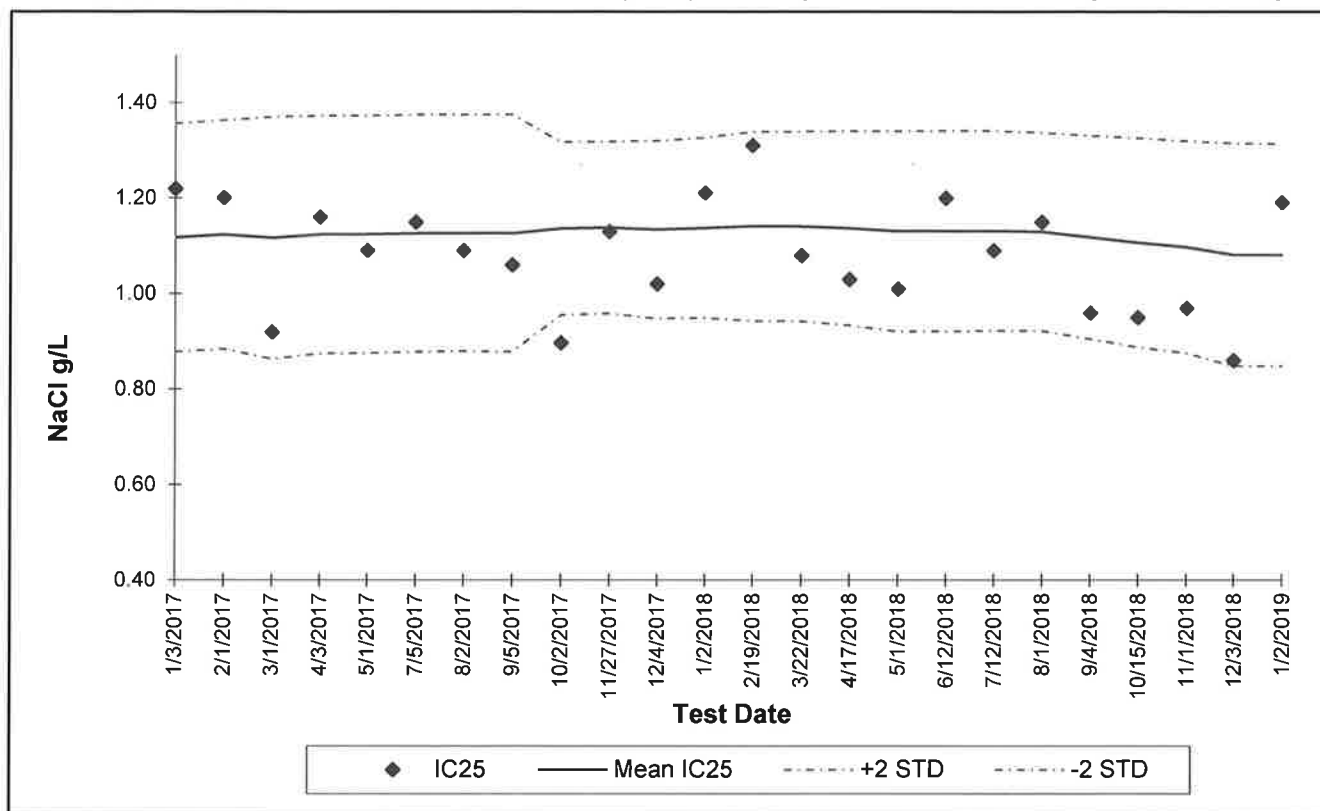
Date Reviewed:

1/23/19

REFERENCE TOXICANT CHARTS

New England Bioassay

Reference Toxicant Data: Sodium chloride (NaCl) *Ceriodaphnia dubia* Chronic Reproduction IC₂₅



Test ID	Date	IC ₂₅	Mean IC ₂₅	STD	-2STD	+2STD	Avg. CV	Repro PMSD (%)	Avg. PMSD (%)
17-14	1/3/2017	1.22	1.12	0.12	0.88	1.36	0.11	10.80	15.85
17-151	2/1/2017	1.20	1.12	0.12	0.88	1.36	0.11	7.93	15.28
17-267	3/1/2017	0.92	1.12	0.13	0.86	1.37	0.11	16.70	15.37
17-480	4/3/2017	1.16	1.12	0.12	0.87	1.37	0.11	13.66	15.27
17-616	5/1/2017	1.09	1.12	0.12	0.88	1.37	0.11	8.00	14.84
17-972	7/5/2017	1.15	1.13	0.12	0.88	1.37	0.11	12.67	14.72
17-1146	8/2/2017	1.09	1.13	0.12	0.88	1.38	0.11	23.94	15.20
17-1317	9/5/2017	1.06	1.13	0.12	0.88	1.38	0.11	33.78	16.13
17-1516	10/2/2017	0.90	1.14	0.09	0.95	1.32	0.08	24.47	16.53
17-1787	11/27/2017	1.13	1.14	0.09	0.96	1.32	0.08	19.97	16.69
17-1846	12/4/2017	1.02	1.13	0.09	0.95	1.32	0.08	14.69	16.60
18-10	1/2/2018	1.21	1.14	0.09	0.95	1.33	0.08	10.81	16.36
18-271	2/19/2018	1.31	1.14	0.10	0.94	1.34	0.09	22.90	16.56
18-416	3/22/2018	1.08	1.14	0.10	0.94	1.34	0.09	17.59	16.88
18-553	4/17/2018	1.03	1.14	0.10	0.93	1.34	0.09	38.54	17.77
18-607	5/1/2018	1.01	1.13	0.10	0.92	1.34	0.09	24.65	18.25
18-816	6/12/2018	1.20	1.13	0.11	0.92	1.34	0.09	46.97	19.59
18-996	7/12/2018	1.09	1.13	0.10	0.92	1.34	0.09	11.41	19.70
18-1103	8/1/2018	1.15	1.13	0.10	0.92	1.34	0.09	17.23	19.67
18-1315	9/4/2018	0.96	1.12	0.11	0.91	1.33	0.10	22.12	20.09
18-1577	10/15/2018	0.95	1.11	0.11	0.89	1.33	0.10	24.32	20.64
18-1625	11/1/2018	0.97	1.10	0.11	0.88	1.32	0.10	31.57	21.34
18-1756	12/3/2018	0.86	1.08	0.12	0.85	1.32	0.11	15.77	21.00
19-8	1/2/2019	1.19	1.08	0.12	0.85	1.31	0.11	40.72	21.30

National 75th Percentile and 90th Percentile CV Averages for *Ceriodaphnia* Reproduction IC₂₅ (EPA 833-R-00-003): 0.45 - 0.62

PMDS Upper and Lower Bounds for *Ceriodaphnia* Reproduction (EPA-821-R-02-013): 13% - 47%

Results:

Sample: Effluent
9A07016-01 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO₃	41	2	mg/L	01/10/19
Ammonia	3.4	0.1	mg/L	01/08/19
pH	6.6	0.1	SU	01/07/19 15:50
Specific Conductance	943	2	uS/cm	01/14/19
Total Dissolved Solids	412	10	mg/L	01/09/19
Total Organic Carbon	6.6	0.2	mg/L	01/10/19
Total solids (TS)	524	10	mg/L	01/09/19
Total Suspended Solids	11	2	mg/L	01/09/19

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	32.7	0.01	mg/L	01/10/19
Magnesium	5.33	0.01	mg/L	01/10/19
Cadmium	ND	0.0001	mg/L	01/10/19
Lead	0.0004	0.0002	mg/L	01/10/19
Aluminum	0.038	0.012	mg/L	01/10/19
Copper	0.009	0.005	mg/L	01/10/19
Nickel	0.002	0.001	mg/L	01/10/19
Zinc	0.075	0.005	mg/L	01/10/19
Total Hardness	103	0.0312	mg/L	01/10/19

Sample: Merrimack River
9A07016-02 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO₃	6	2	mg/L	01/10/19
Ammonia	0.1	0.1	mg/L	01/08/19
pH	6.0	0.1	SU	01/07/19 15:50
Specific Conductance	137	2	uS/cm	01/14/19
Total Dissolved Solids	16	10	mg/L	01/09/19
Total Organic Carbon	3.3	0.2	mg/L	01/10/19
Total solids (TS)	64	10	mg/L	01/09/19
Total Suspended Solids	ND	2	mg/L	01/09/19

Sample: Merrimack River (Continued)
9A07016-02 (Water)

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	5.99	0.01	mg/L	01/10/19
Magnesium	1.11	0.01	mg/L	01/10/19
Cadmium	ND	0.0001	mg/L	01/10/19
Lead	ND	0.0002	mg/L	01/10/19
Aluminum	0.095	0.012	mg/L	01/10/19
Copper	ND	0.005	mg/L	01/10/19
Nickel	ND	0.001	mg/L	01/10/19
Zinc	0.013	0.005	mg/L	01/10/19
Total Hardness	19.5	0.0312	mg/L	01/10/19

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN-BAC MC GOWAN
 Title: CHEMIST
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: _____
 Start Date: 1-6-2019 Time: 7:00 AM
 End Date: 1-7-2019 Time: 7:00 AM

Sampling Method: _____ Grab (for pH and TRC only _____)

Date Collected: _____
 Time Collected: _____

Sample Type: _____ Prechlorinated
X Dechlorinated
 _____ Unchlorinated
 _____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge.
(Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: [Signature]
 Received By: [Signature]
 Relinquished By: [Signature]
 Received By: [Signature]
 Relinquished By: [Signature]
 Received By: [Signature]

Date: 1-7-19 Time: 10:30 AM
 Date: 1/7/19 Time: 1030
 Date: 1/7/19 Time: 1045
 Date: 1-7-19 Time: 10:45
 Date: 1-7-19 Time: 1300
 Date: 1/7/19 Time: 1300
 Relinquished ON ICE

FOR NEB USE ONLY

* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory *

Temperature of Effluent Upon Receipt at Lab: 3.2 °C Temperature of Receiving Water Upon Receipt at Lab: 4.0 °C
 Effluent COC# C39-1029 Receiving Water COC# C39-1030

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sample Set #2

Sampler: JIN-BOK MCGOWAN
 Title: CHEMIST
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: _____
 Start Date: 1-8-2019 Time: 7:00 AM
 End Date: 1-9-2019 Time: 7:00 AM

Sampling Method: _____ Grab (for pH and TRC only _____)

Date Collected: _____
 Time Collected: _____

Sample Type: _____ Prechlorinated
X Dechlorinated
 _____ Unchlorinated
 _____ Chlorinated

RECEIVING WATER

Sampler: THOMAS E. KAWA
 Title: Ops. Superintendent
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River
 Date Collected: 1-9-19
 Time Collected: 7:45 AM

Received
ON ICE

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: [Signature]
 Received By: Blanchard
 Relinquished By: Blanchard
 Received By: Ch. R.
 Relinquished By: _____
 Received By: Joyce Benoit

Date: 1-9-19 Time: 10:00 AM
 Date: 1-9-18 Time: 1005
 Date: 1-9-18 Time: 1316
 Date: 1-9-18 Time: 1316
 Date: _____ Time: 1507
 Date: 1-9-19 Time: 1513

FOR NEB USE ONLY

* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory *

Temperature of Effluent Upon Receipt at Lab: 1.5 °C

Temperature of Receiving Water Upon Receipt at Lab: 1.3 °C

Effluent COC# 039-1079

Receiving Water COC# 039-1080

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JAN-BOE M'GOWAN
 Title: CHEMIST
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: ☒ Composite

Sample ID: _____
 Start Date: 1-10-2019 Time: 7:00 AM
 End Date: 1-11-2019 Time: 7:00 AM

Sampling Method: ☐ Grab (for pH and TRC only _____)

Date Collected: _____
 Time Collected: _____

Sample Type: ☐ Prechlorinated
☒ Dechlorinated
☐ Unchlorinated
☐ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge.
(Rt.38)

Requested Analysis: ☒ Chronic and modified acute

Received
ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: <u>[Signature]</u>	Date: <u>1-11-19</u>	Time: <u>10:00 AM</u>
Received By: <u>[Signature]</u>	Date: <u>1-11-19</u>	Time: <u>1000</u>
Relinquished By: <u>[Signature]</u>	Date: <u>1-11-2019</u>	Time: <u>13:20</u>
Received By: <u>[Signature]</u>	Date: <u>1/11/19</u>	Time: <u>1320</u>
Relinquished By: _____	Date: _____	Time: _____
Received By: _____	Date: _____	Time: _____

FOR NEB USE ONLY

* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory *

Temperature of Effluent Upon Receipt at Lab: 7.0 °C

Temperature of Receiving Water Upon Receipt at Lab: 5.4 °C

Effluent COC# 039-1115

Receiving Water COC# 039-1116

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042